

Remarks/Arguments:

By this Amendment, Applicants have amended claim 5. Claims 1-7 and 9-22 are pending.

Allowed Claims

Applicants acknowledge with appreciation the Examiner's finding that claims 1-3, 7, 9-14, 17, and 18-22 are allowed.

Claim Rejections under Section 103

Claims 4 and 15 stand rejected under 35 U.S.C. Section 103(a) as being unpatentable over Kuriyama in view of Kojima and Kawaguchi. Applicants respectfully traverse the Section 103(a) rejection.

Claim 4 is an independent claim to which claim 15 depends.

Claim 4 is directed to a field emission-type electrode source device and includes the following features:

- a field emission electron source portion including an extraction electrode provided on a p-type silicon substrate via an insulating film and having an opening portion at a position corresponding to a region where an electrode is provided, and a cathode portion provided on the p-type silicon substrate and at a position corresponding to the opening portion of the extraction electrode, and
- an n-channel field effect transistor portion provided on the p-type silicon substrate, corresponding to the field emission electrode source portion,

- wherein, the field emission electrode source portion is provided in a drain region of the field effect transistor portion, and a control voltage is applied to a gate electrode of the field effect transistor portion to control a field emission current from the field emission electron source portion,
- the gate electrode of the field effect transistor portion has a shape such that a portion of the gate electrode nearer the drain region has a total width wider than a total width of a portion of the source electrode nearer the source region, and
- **a part of the gate electrode is provided in such a manner as to cover an end of the drain region.**

Applicants respectfully submit that the field emission-type electron source device defined by claim 4 is patentably distinguished from the Kuriyama Patent, the Kojima Patent and the Kawaguchi Reference at least based on the requirement that a part of the gate electrode is provided in such a manner as to cover an end of the drain region. This feature is neither taught nor suggested by the cited references. Applicants have specifically pointed out the advantage of the feature of a part of the gate electrode being provided to cover an end of the drain region in the originally filed specification at page 30, lines 7-21. The above identified feature of Applicants' claimed invention, as well as its advantage, is neither taught nor appreciated by any of the cited references.

The Office Action has rejected claim 4 primarily on the basis of the Kuriyama Patent. The Kuriyama Patent in general relates to a field emission cathode apparatus comprising plural electron-emitters which eliminate non-uniformity of electric emission density over an emissive area, and controls emission currents by active devices. Figures 1 and 3 are the primary figures

relied on in the Office Action. Turning first to Figure 3, it shows a field effect transistor with a gate electrode 8 positioned so as to overlap a channel region 4 (see Column 4, lines 34-48 of the Kuriyama Patent). But it is very relevant to note that the Kuriyama Patent specifically states that the gate electrode 8 does not cover the drain region, because at Column 4, lines 47-48, the Kuriyama Patent states that only the electrode emitter 1 and the n+ type silicon 6 are considered as a drain electrode. More specifically, the Kuriyama Patent at Column 4, lines 47-48 states, "Electron-emitter 1 and n+-type silicon 6 serves as a **drain electrode in one**" (emphasis added). Thus, it is quite apparent that the field emission cathode apparatus of Figure 3 does not teach or suggest the feature of Applicants' claimed invention of a part of the gate electrode being provided in such a manner as to cover an end of the drain region.

It is Applicants further contention that the above noted feature of Applicants' claimed invention is not taught by the field emission cathode apparatus shown in Figure 1 of the Kuriyama Patent. At Column 3, lines 59-62 of the Kuriyama Patent specifically states that the n-type silicon 4 is described specifically as a channel, whereas the electron emitter 1 is described as the drain. More specifically, the Kuriyama Patent states at Column 3, lines 59-62 that "wherein electron-emitter 1, n-type silicon 4, p-type silicon 5 and n+-type silicon 6 **corresponds to a drain**, an n-channel, a gate and a source respectively. By varying the voltage applied to p-type silicon 5, the electron current flowing in the **n-channel, (n-type silicon 4)**" (emphasis added). Thus, the above quoted feature of Applicants' claimed invention is also not taught by the field emission cathode apparatus of Figure 1 of the Kuriyama Patent. In point of fact, no portion of the Kuriyama Patent teaches the feature of Applicants' claimed invention that a part of the gate electrode is provided in such a manner as to cover an end of

the drain region. This feature is also not taught by either the Kojima Patent or the Kawaguchi Reference.

The Kojima Patent relates in general to an integrated circuit-type semiconductor device consisting of MISFETs, with high rated voltage characteristics in a gate insulation film structure. And the Kawaguchi Reference in general relates to an MOS transistor with a gate width being wider on the drain side of the gate than on the source side. But neither the Kojima Patent nor the Kawaguchi Reference teach or suggest the feature of Applicants' claimed invention of a part of the gate electrode being provided in such a manner as to cover an end of the drain region.

The Office Action at page 3 and at the Response to Arguments section (page 10) takes the position that the channel region 4 in the Kuriyama Patent corresponds to the drain region based on similarities between Figure 3 of the Kuriyama Patent and Figure 3 of the subject application. Specifically, the Examiner asserts that in the subject specification, the gate electrode only overlaps the lightly doped drain region 34 and not the drain region 33, and that the channel region 4 in Kuriyama would be considered as a lightly doped drain region. Therefore the Examiner concludes that the Kuriyama Patent teaches the structure of Applicants' claimed invention. Applicants respectfully disagree. In making this argument, the Examiner at the bottom of page 10 and continuing through to page 11 refers to Applicants specification. In other words, the Examiner is basing this Section 103 rejection on Applicants' own disclosure, which is contrary to proper patent practice. It is well established that an Applicants' disclosure cannot be used as a basis of an obviousness rejection. Such is nothing more than hindsight reconstruction of Applicants' claimed invention. Because the Kuriyama Patent specifically teaches that the gate electrode does not overlap the drain region, then there would be no motivation for one skilled in the art to overlap the gate electrode with a drain region (as taught

by the Kuriyama Patent), even a lightly doped drain region, without the very disclosure of Applicants' specification. Applicants therefore submit that the basis for the Examiner's rejection of claim 4, as well as dependent claim 15, is flawed.

Applicants therefore request that the Section 103(a) rejection directed to claims 4 and 15 be withdrawn.

Claims 5 and 16 stand rejected under 35 U.S.C. Section 103(a) as being unpatentable over Kuriyama in view of Kojima. Based on this Amendment, Applicants respectfully traverse this Section 103(a) rejection.

Claim 5 is an independent claim to which claim 6 and 16 depend. Claim 5 is directed to a field emission-type electron source device and includes among its features the following:

- a gate insulating film formed by thermal oxidation of silicon is provided between the gate electrode and the field effect transistor and the p-type silicon substrate, the gate insulating film is a film thinner than the first insulating film, the first insulating film being provided between the extraction electrode and the p-type silicon substrate, and the gate electrode is buried with the first insulating film.

It is Applicants' position that the above quoted portion of claim 5 relating to the gate insulating film and the first insulating film defines a feature which is neither taught nor suggested in any of the references of record. In addition, the advantages associated with this feature of Applicants' claimed invention is set forth at page 12, lines 5-11 of the originally filed specification. The above quoted feature provides that advantage that the gate insulating film is thinner than the first insulating film and can therefore be of a higher quality, such as by thermal oxidation of silicon.

The Kuriyama Patent, with respect to Figure 3, discloses a single insulator layer 3 in which is enclosed a gate electrode 8. But the Kuriyama Patent does not teach or suggest (as required by Applicants' claimed invention) a gate insulating layer underneath the gate electrode and a separate first insulating layer being above the gate insulating layer. It is apparent from the field emission type electron source device defined by claim 5 that the gate insulating film and the first insulating film are separate films — particularly in view of the fact that the gate insulating film is a film thinner than the first insulating film. In addition, the Kuriyama Patent does not teach or suggest that the gate insulating layer is formed by thermal oxidation of silicon as set forth in Applicants' amended claim 5.

It appears from the Office Action that the Examiner has taken the position that the single insulator layer 3 includes both the gate insulating film and the first insulating film as defined by Applicants' claim 5. Applicants contend that making such an analogy to the gate insulating film and the first insulating film is not proper. But Applicants have nonetheless amended claim 5 to more clearly clarify this distinction by indicating that the gate insulating film is formed by thermal oxidation of silicon. The Kuriyama Patent does not teach or suggest that the single insulator layer 3 comprises a film formed by thermal oxidation of silicon as it extends below the gate electrode. Simply put, Applicants' claim 5 effectively defines the gate insulating film and first insulating film so that one skilled in the art would recognize that they are different insulating films and that they are positioned differently in the claimed field emission-type electron source device.

The Kojima Patent as previously discussed concerns an integrated circuit-type semiconductor device including MISFETs. The Kojima Patent has been cited primarily with respect to the semiconductor device shown in Figure 7, but nowhere in Figure 7 or anywhere

else in the Kojima Patent is there any teaching or suggestion of the feature of the gate insulating film and the first insulating film as defined in Applicants' claim 5.

Based on the foregoing remarks, Applicants respectfully submit that claim 5, as well as dependent claims 6 and 16, are patentably distinguished from the references of record. Applicants therefore request that the Section 103(a) rejection be withdrawn.

Claim 6 stands rejected under 35 U.S.C. Section 103(a) as being unpatentable over Kuriyama and Kojima in view of Hirano. By this Amendment, Applicants respectfully traverse this Section 103(a) rejection.

Claim 6 is dependent on claim 5 and is therefore patentably distinguished from the Kuriyama and Kojima Patents for the same reasons as discussed above. It is Applicants' contention that the Hirano Reference does not overcome the deficiencies heretofore discussed with respect to the Kuriyama and Kojima Patents.

The Hirano Reference has been cited with respect to the forming of a gate insulating film by thermal oxidation of silicon during the sharpening of the tip of the cathode portion. But there is simply no teaching or suggestion in the Hirano Reference concerning the gate insulating film made by thermal oxidation of silicon and the first insulating film as defined by Applicants' claim 5. Therefore, Applicants respectfully submit that dependent claim 6 is patentably distinguished from all of the reference of record. Withdrawal of the Section 103(a) rejection directed to claim 6 is requested.

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In view of the foregoing remarks and amendments, Applicants respectfully submit that claims 4, 5, 6, 15, and 16 are condition for allowance. Claims 1-3, 7, 9-13, and 17-22 have been found allowed. Reconsideration and allowance of all pending claims is the refore respectfully requested.

Respectfully submitted,

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